

FASTING AND UNDERNUTRITION IN THE TREATMENT OF DIABETES

I

INTRODUCTORY REMARKS

There is no pathological condition in the clinical control of which dietary treatment plays such a paramount influence as in diabetes mellitus. There is no other agent except a proper regulation of the diet that has ever been of any real value in reducing the two cardinal symptoms of diabetes: weakness and glycosuria. This fact has been definitely recognized ever since the advent of the physiological school of medicine.

Diabetes is and remains a wasting disease. By a rational system of dieting adapted to the individual case and to each period in the course of the affection, the painstaking clinician is often enabled to stem its progress—or rather its rapid progress—for the time being. This dietary individualization consists of the *periodical* diminution or the *temporary* withdrawal of one or all the types of nutriment.

The almost universal tonic for the confirmed

diabetic is the permanent, or almost permanent, complete withdrawal of all the sugar-containing aliments, and the greater or lesser temporary reduction of starchy foods. Upon this plan of withholding and decrease the management of the average case of diabetes has been based since the times of Pavy, Külz, Bouchardat, Ebstein and Naunyn.

There are numerous modifications of the sugar-free and starch-poor regimen. In the end all pertaining restrictions and modifications amount to the same thing: to render the patient stronger and more resistant, and sugar-free.

A logical outcome of Chittenden's "Physiological Economy in Nutrition," published in 1904, was that about two or three years later the proteins, especially those derived from meats, were also to a certain extent withheld from the diabetic. Finally a few clinicians decided that the reduction of all the types of nutriment was the *sine qua non* in the treatment of diabetes. While it was the accepted dictum before the investigations of Chittenden that the diabetic should be maintained in a rather continuous state of over-nutrition, a doctrine has lately been promulgated according to which the life of the diabetic should be one of everlasting renunciation and under-nutrition. The first therapeutic conception is based on the assumption that diabetes is a wasting disease; the latter conception on the observation that a few diabetics get along better and become

more active after they have lost ten, twenty or more pounds.

On the face of it, however, the treatment of the average case of diabetes by a system of continuous undernutrition bears the stamp of inexperience, irrationality and harmfulness. Such a plan of treatment has its place in a small proportion of the cases of diabetes, in such cases in which besides a persistent glycosuria, a pronounced and obstinate ketonosis (acidosis) and rapid decline of body-weight and strength are present.

Here, it is true, fasting and undernutrition may produce wonders; in the preponderating majority of instances of diabetes, however, the patient will get along much better, and is apt to remain a useful member of society for a number of years if he be not kept below par.

On the other hand, forced feeding in diabetes is not always devoid of danger. Instead of assisting in the adjustment of the activity of the liver, continued overalimentation is bound to diminish and undermine, sooner or later, the function of this most important organ of the human body. Again, a liver that is not functioning perfectly can neither prevent the alimentary poisons from entering into the general blood stream, nor is it able to cause normal cleavage of the intermediary products of metabolism.

That total abstinence from food for from three to four successive days renders the urine of the

patient with severe diabetes sugar-free and "disintoxicates" the diabetic organism, was the important observation of G. Guelpa, of Paris. This clinical discovery has proved of great moment in the management of both (1) the grave types of diabetes, and (2) the overnourished cases of diabetes in which the liver no longer affords the necessary protection against the various forms of autointoxication. While it is true that the discoverer's own hypotheses respecting the rationale of the fasting treatment of diabetes are to the greater part scientifically untenable, it is nevertheless Guelpa who has shown us a way out of the bewildering vagaries of diabetes therapy. We should never forget that it was this French clinician who first in all the world declared that all food may be withheld for a number of days from a human diabetic without inciting ketonosis (acidosis) and subsequent coma. By one leap the treatment of severe diabetes has suddenly made more progress than it has for the previous quarter of a century.

Guelpa's "cure by privation" (abstinence from food and purgation) consists of the following:*

First. The taking every day for two, three or

* Guelpa: *Starvation and Purgation in the Relief of Disease*. Brit. Med. Ass., July, 1910. Published in Brit. Med. Jour., Oct. 8, 1910. Guelpa: *Autointoxication and Disintoxication*. Translated by F. S. Arnold, B.A., M.B., B.Ch. (Oxon.), New York, Rebman Company.

four days of a bottle of Hunyadi Janos water, warmed if possible, or from 40 to 55 c.c. (mils)=one and one-quarter to one and three-quarters ounces of castor oil, followed by about 750 c.c. (mils)=one pint and a half—of water.

Second. The abstinence during this period of all kinds of food.

Third. The free imbibing of water (not carbonated), weak tea without milk, toast and water, fruit infusion, etc. (Up to the time of the publication of the translation of his book, Guelpa had avoided any drug treatment whatever, as he wished to prevent any self-deception concerning the therapeutic influence of the treatment.)

Guelpa declares that it is only rarely that a patient has difficulty in completing his three or more days' fast. This he finds especially true if the purge and the other liquids that are imbibed during the fasting period are taken warm. The method of treatment usually calls forth pronounced improvement in the patient's state of health. In no instance had any aggravation of the disease resulted on account of the fasting and purging.

The benefits accruing from this plan of treatment are, according to Guelpa, the following:

First. Total disappearance of the annoying and distressing sensation of hunger.

Second. Marked decrease of the intestinal bacteria, and therefore a pretty perfect state of disinfection of the intestinal tract.

Third. Pronounced reduction of thirst.

Fourth. Suppression or conspicuous decline of perspiration, even in the heat of summer.

Fifth. Production of normal, periodic sleep, very refreshing though somewhat shortened in length. The patient, awakening passes through no stage of drowsiness; full mental activity ensuing immediately.

Sixth. Firmness of the pulse and diminution of blood pressure, and increase in hemoglobin, red cells and leukocytes.

Seventh. A decrease in the volume of certain visceral organs, particularly the heart and liver, with greater and easier lung expansion.

Eighth. Continuous loss in body weight, at the average rate of two pounds a day. Concurring therewith the activity of the heart and other organs becomes less oppressed.

Ninth. Disappearance of joint and muscular pains and the production of a feeling of agility, liveliness and well-being.

Excepting a few loose statements concerning a low protein intake, Guelpa has not devoted much attention to the *dietary treatment following the fasting periods*. More or less he has concentrated his therapeutic endeavors upon that what is now understood as the "initial fast," and has given no or but scant rules how to proceed as regards the food-intake after the fasting period is broken. Yet the question how to go ahead after the fasting days without occasioning the reoccurrence of

sugar and ketones is the only intricate one connected with the plan of treatment. The fasting period itself offers no difficulty whatever.

Fasting and undernutrition in the treatment of diabetes must never assume a stereotyped character. Some patients do well on a one or two days' fast and a week of undernutrition; in others the fasting period should extend over five, six or more days, and the subsequent undernutrition should be continued for one, two, three or more months. In some diabetics of the graver types a fast day weekly or fortnightly and a slight reduction of the diet may keep the disease in check, in others the duration of the periodical fasting term and a much more decided reduction of alimentation are necessary to accomplish the desired end.

Fasting with subsequent undernutrition must go hand in hand in the treatment of the severe forms of diabetes. This fact was already recognized in some degree by Naunyn when he advocated the interpolation of "green days" in the dietary of the patient affected with grave or advanced diabetes. These "green days," however, are to all intents and purposes fast days, as the patient obtains on them but a certain amount of green vegetables whose low starch content is not readily attacked by the digestive juices.

Undernutrition in diabetes, as I understand and uphold it, is not the reduction of the intake of one class of foodstuffs, but of all of them. The

proportion in the diminution of the various articles of food must, however, of necessity differ in the various phases after the fast. Fats, particularly those of high melting point, may practically always be permitted, though they may on rare occasions give rise to a slight ketonosis (acidosis) or aggravate an already existing one. Proteins of animal origin, in more or less reduced amounts, must be resorted to soon after the fast. The patient simply cannot get along without them, despite the assertions of some clinicians to the contrary. Great care, however, must be exercised that the ingested proteins do not overburden the liver. The starches should be added latest and then only in the form of vegetables containing at first not more than five per cent. of carbohydrate matter which is not readily elaborated by intestinal activity.

It is now almost six years since I started to make use of Guelpa's method in suitable cases. Naturally, I have modified and amplified it according to the needs of the manifold cases which have come under my observation since that time. The general plan of treatment by fasting and undernutrition, as evolved by me, differs in more than one respect from similar endeavors. This plan of treatment which is minutely dwelled upon in the following pages is designed as a guide, pure and simple, and as such it merely points to a course of procedure, but it is readily capable of modification and adaptation to individual demands.

II

TECHNIC OF THERAPEUTIC FASTING IN DIABETES

Where to take the fasts

While the hospital, on account of its laboratory and other facilities, may be the best place in which to let the patient take his initial fast, the home, for reasons presently to be explained, is after all to be preferred when the patient has to submit to frequently repeated fasting periods. The fasts in order to do any good should be undertaken at certain, preferably regular intervals. One fast is of little consequence, and it should be remembered that one swallow does not make a summer.

The arguments in favor of home treatment are, (1) the simplicity of the management of the case itself; (2) the simplicity of the necessary tests which, if need be, may be performed at the bedside by the physician, a nurse or by the patient himself; (3) the accustomed atmosphere which is much less apt to depress the patient than the hospital milieu, and (4) the inexpensiveness as compared with the extravagant hospital charges.

The patient should be resting in bed during the entire course of the fast. The room should have a southern exposure, if possible, but it must

not be artificially heated. The toilet, if conveniently located, may be used by the patient. If this be not the case a commode must be employed.

The attending physician

During the inaugural fasting period the attending physician should make daily calls and personally assure himself of the patient's physical condition. He should perform or should have performed a blood examination for glucose before the fast is started. In the beginning it is well to examine for blood-sugar every third or fourth day. This, however, is not imperative. The urine should be tested every day for grape-sugar and the ketone substances, especially acetone and diacetic acid. (The examination for beta-oxybutyric acid is difficult and time-consuming, and is by no means essential in the general run of cases.)

During subsequent fasts—provided no complications ensue—the physician need not pay any calls. He should, however, make a daily urinary assay. If there be any indication, an examination for blood-sugar should be made at the beginning and conclusion of each subsequent fast. The physician should give his orders either to a nurse, a member of the family or to the patient himself.

The nurse

The initial fasting period should be under the direct and continued supervision of a nurse. The

nurse, as a matter of course, receives her instructions from the attending physician to whom he or she should report the patient's condition as often as the exigencies of the case demand. It is the nurse who has to minister to the wants of the patient and who has to keep him as comfortable as possible. It is the nurse—and this should be particularly the case during the initial fast—who forms besides the physician the sole means of communication between the patient and the outside world.

The nurse should keep a chart of the temperature, pulse and respiration which should be recorded from three to five times during the twenty-four hours. The temperature should always be taken in the rectum unless a disease of the same precludes this. The condition of the skin should be recorded, whether it be warm or cold, dry or moist, etc. Besides an exact account, both as to the amount and the time of the intake of liquids and the output of urine and feces must be kept by the nurse. In subsequent fasts, when the diabetic state of the patient is no longer an unknown factor to the medical observer, it is not essential that a detailed chart be kept in the average case.

The nurse need not belong to the privileged "registered" class. Any member of the family with a little common sense, possessing some tact and devotion, is able to nurse an uncomplicated case of the graver forms of diabetes during all but the initial fasts. Many servants who watch

the doings of the trained attendant during the initial fasting period will make excellent nurses for cases during the periods of fasting and under-nutrition. Indeed, my best nurses for patients suffering from nutritive disturbances I have recruited from the ranks of the "unregistered," the common garden and field variety of attendants. Last but not least, they receive only from one-third to one-half the salary which the "R. N." exacts.

The patient his own nurse

I am often asked by the patient why he cannot act as his own nurse during the therapeutic fasts. Excepting, of course, the initial fast when valuable data for the future guidance of his case are to be gained and when he is necessarily to be kept under close medical surveillance, the question is certainly justified as, roughly speaking, about half of the cases get along quite nicely without any special assistance. It is my experience that male diabetics may be more trusted in this respect than their female fellow-sufferers. As a rule, the members of the stronger sex have a much better conception of their disease than those of the weaker one, and men have a much keener appreciation than women of the necessity that something be done for their infirmity. Of course, when entirely without the help of somebody the diabetic patient cannot keep his fast. Someone has to make his bed, prepare the per-

mitted liquids for him, and do other chores. However, as just stated, about one-half of the cases need no *special* attendance whatever.

The patient himself

It goes without saying that the patient must have full confidence in his physician. He should talk matters over with him, and not start fasting unless he feels assured that this therapeutic measure is going to benefit his condition. The patient should become acquainted with the fact that the fast is to be immediately followed by a more or less protracted period of undernutrition. He must foster a certain degree of self-denial and assume a mental attitude of submission, good will and trust. He must be entirely free from mental unrest, and for this reason should put his house in order before he attempts the fasts. He must not question the orders of his physician once the fast has begun. Worry, exaltation and excitement are only too apt to aggravate a case of diabetes and to increase the intensity of the sugar excretion.

The patient will note that when the ice is once broken, viz., after he has undergone the initial fast, that there are worse things than abstaining from food for a number of days. In subsequent fasts many patients are masters of the situation, indeed so much so that everything connected with the therapeutic fasts, even the slightest detail, may be left to their own discretion and execution.

The cooperation of such patients with their physicians spells success—if a favorable issue can be obtained by this plan of treatment.

Duration of the fast

The average ketonemic diabetic voids a sugar and acetone-free urine in from three to five days after starting the initial fast. A majority of these patients cease to excrete sugar within forty-eight or sixty hours. In some patients the glycosuric symptom already terminates after the omission of two or three meals; in others it persists for six days or even longer. Again, there are cases of the severest type of diabetes which no amount of fasting will render sugar-free. Generally speaking, the initial fast should not come to an end when sugar ceases to be excreted, but should be continued for another twenty-four or forty-eight hours.

It always takes longer to render the patient's urine free from ketones (diacetic acid, acetone, beta-oxybutyric acid, etc.) than from sugar. In a rather considerable number of instances—twenty-five per cent. approximately—no amount of fasting will accomplish this feat. In these cases prolonged starvation treatment is out of place; the accustomed diet should be taken up as soon as possible.

Subsequent fasts need hardly ever be protracted unless the intervening period has been an exceptionally long one. The intercalation of a

hunger-day, as advocated by former authors, will often suffice.

Frequency of the fast

No iron-clad rules concerning the frequency of the therapeutic fasts can be propounded. Once the inaugural fast is over and the severity of the case determined (*i.e.*, the readiness of the disappearance and reappearance of the urinary sugar and ketones), it is a simple matter to decide when and how often subsequent fasts should be undertaken. The decision resolves itself in the answering of the following two questions: *Firstly*, has the inaugural fast been of benefit to the patient; *secondly*, is the patient to be kept entirely sugar- and acetone-free during the interval.

It should be the physician's endeavor not only to prolong life, but also to prolong the usefulness of his patient. For years I have advocated that the diabetic with low carbohydrate tolerance and a tendency to acetonuria should make a fast-day of that which is euphoniously called "the day of rest." If possible, I let him also add the Saturday half-holiday. By cutting out the Saturday mid-day meal and permitting a very moderate supper on Sunday, a fasting period of about thirty hours is obtained without interfering with the patient's business. I am in the habit of allowing a small amount of food on Sunday evening in order that the patient is able to resume work the next morning, which he does after taking his

regular breakfast. These weekly fasts are a great boon to the average patient affected with a severe type of diabetes, and often enable him to gether with the restricted diet during the week to keep above water in a physical, financial and social sense.

In many cases a one-day fast every second or third week may suffice, in others of the severer and severest types more protracted fasting periods—for from two to four days—should be instituted every two weeks. Thus it may be necessary that four days out of every fourteen must be spent fasting. It should not be forgotten, however, that a certain proportion of these cases are not only not benefited but actually harmed by this treatment. The initial fast enables the clinician to recognize the cases not suited for the fasting-undernutrition treatment.

The indications for instituting protracted fasting periods other than the initial one, are: progressive weakness of the patient, certain complications like gangrene and infection, very low or negative carbohydrate tolerance, pronounced ketonosis (acetonuria, acidosis, etc.), heart disease (fat heart), marked obesity and disease of the liver (hepatic inefficiency) and kidneys (renal insufficiency).

All subsequent protracted fasting must occur while the patient is resting in bed and under the same general conditions as the inaugural fast. A single weekly fast-day, however, does not call for

bed-rest, especially not in summer time. The patient may spend the day in the open air, reclining in a steamer chair or other comfortable piece of furniture, but away from the hustle and bustle of every-day life.

Other essentials in therapeutic fasting

A. *Purging*.—Inasmuch as fasting in the graver forms of diabetes is considered by Guelpa to be a method of disintoxication, he combines the treatment for the sake of greater efficacy with purgation. The natural Hungarian bitter waters, Carlsbad water and the less concentrated solutions of sodium or magnesium sulphate are best suited for the purpose provided there be no kidney disease.

Of the natural mineral waters not less than two tumblerfuls, heated to about 130 deg. F., should be taken at one time, preferably in the morning. If the bowels have moved less than twice during the day, the dose should be repeated in the late afternoon. If a solution of sodium or magnesium sulphate should be prepared extemporaneously not more than one and one-half teaspoonful should be added to each glass of warm water. Two glasses of the solutions are a dose. The purge is to be taken in the morning and, if necessary, also in the early evening. In instances with impaired kidney efficiency castor oil should be substituted for the solutions of Epsom and Glauber's salts. It should be administered once

a day in doses from 30 to 60 c.c. (mils)=1 to 2 ounces. Care must be taken that it be not admixed with any sweetening material.

In the average case these purgatives must be exhibited every day as long as the fast lasts. They should not be replaced by any other laxatives, especially not by drugs containing sugar, such as elixirs of cascara sagrada, magnesium citrate, compound powder of licorice, etc.

B. *Drinking*.—The continuance of the normal physico-chemical processes in the organism demands that a certain amount of liquids be imbibed. At the same time fluids are the carriers of a great number of excretory substances. Water may practically be partaken of at pleasure by the fasting diabetic provided there is no contraindication offered by advanced cardio-vascular disease and a general hydremic condition. The patient may drink from 20 to 40 c.c. of water for each kilogram (from a little more than $\frac{1}{2}$ ounce to somewhat more than 1 ounce for each pound) of body weight in the twenty-four hours. A man weighing 60 kilograms (132 pounds) may therefore take daily from about 1200 to 2400 c.c. (35 to 50 ounces) of water. Only still water should be permitted, as carbonated waters are apt to produce gastro-intestinal and vesical discomfort.

Some of the necessary liquid may be given in the form of a weak infusion of tea. Of course, this must be taken without milk or sugar, but

some lemon juice is permissible. Three, four or even five cups of weak tea may be drunk during the twenty-four hours, but the liquid thus imbibed should be deducted from the total amount that is allowed. The tea (as well as other fluids) may be taken as warm as desired unless there be a gastric or duodenal disease, ulcer for instance. Then, of necessity, the liquids must be taken lukewarm or cold. Occasionally tea is not well-borne; it may occasion headache or a slight gastric disturbance, an undue diuresis, or it may agitate the patient, preventing sleep. In such cases I am in the habit of ordering a very weak infusion of chamomile which is a wholesome and satisfactory drink. In rare cases I permit coffee. However, it usually overstimulates the patient and the reaction never fails to make itself known. This reaction manifests itself by a pathological depression. Not more than two cups of rather weak coffee should be allowed for each day of the fast.

If the fast is to be continued for longer than two days some hot beef broth, a cupful at midday and the same amount five hours later, will act as a mild stimulant. The quantity of the broth should also be deducted from the total amount of permitted liquid.

Sparers of body tissue

There are certain substances the ingestion of which may prevent too rapid and too pronounced a decline of body weight when the organism is in

a state of therapeutic fasting. The best known substances of this class are alcohol and gelatine.

A. *Alcohol*.—Alcohol is by no means as valuable a saver of body structures as gelatine. Positive proof that it saves the tissues in healthy man is absolutely wanting. However, alcohol is a time-honored adjuvant in the treatment of a number of wasting diseases, and its stimulating action is certainly of benefit to many patients. Small doses of alcohol, that is about 0.5 c.c. per day for each kilogram of body weight (about one drachm per pound) may be permitted. A person weighing sixty kilograms (132 pounds) could therefore consume in the neighborhood of 30 c.c. (one ounce) of alcohol per day. As the distilled liquors contain on the average about fifty per cent. of alcohol, a patient of above weight may take 60 c.c. (two ounces) of whiskey or brandy in the twenty-four hours. In exceptional cases twice the amount even may be permitted. These alcoholic beverages should be well-diluted with plain water, and given in small doses every two, three or four hours.

B. *Gelatine*.—Gelatine does not appear to be a builder of body-albumin, but it spares circulatory proteid. Hence, it prevents or limits the loss of body-albumin. The albumin-saving property of gelatine is at least twice as large as that of the fats and carbohydrates, as 100 grams of it can replace 36 grams albumin, that is about 175 grams of meat. Of course, the gelatinous substances can-

not entirely prevent loss of tissue albumin, and, for this reason, a certain amount of albumins proper must ordinarily form a constituent of the nourishment. In the gravest forms of diabetes when glucose and ketones are being excreted in considerable quantities, the ingested gelatine still produces bodily energy, and averts rapid body waste without increasing the sugar output in any marked degree.

Gelatine may also be a sparer of body-fat. However, its influence in this respect is more limited than in regard to the body-protein. Still, 100 grams gelatin prevent disintegration of 25 grams body-fat, a fact which may be made use of in the suppression of the ketone substances (acetone bodies). In the latter respect it is, indeed, a much more valuable substance than alcohol.

The tissue-sparing properties of gelatine are only limited by the comparatively small amount of the substance which the organism will tolerate without aversion.

It is always best to have on hand two or more differently flavored gelatines when treating a diabetic. Gelatines to which is added some lemon juice or some beef extract, beef juice and their like are especially cherished by the fasting patient. Such preparations may be given alternately, from a teaspoonful to a tablespoonful at a time. The diurnal intake should not exceed 10 or 15 grams (one-third to one-half ounce) of gelatine (in the raw).

Drugs

Medicines have little or no influence upon the excretion of sugar or the ketones and are certainly out of place during the therapeutic fast of the diabetic. The much vaunted, but in the suppression of acidosis entirely useless sodium bicarbonate, is included in this pronunciamiento.

Even if there were any proof of the antiglycemic or antiketonotic properties of certain drugs, their employ would still be contraindicated in the fasting diabetic for the reason that the therapeutic influence of the fast alone be recognized. This is especially true in the inaugural fast.

Again, the fact must not be lost sight of that in the fasting person most medicines exert their physiological effects much more readily than in the individual that is properly nourished. If, therefore, the attending physician, for one or the other reason, does not think he is able to get along without a certain drug, he should, if it be a potent one, prescribe it in smaller than the accustomed doses. Under all circumstances, however, he should rid himself of the superstition that any medicine which he may order is able to control or modify the sugar or acetone output of his patient.

The average diabetic on a fast sleeps on and off from twelve to eighteen hours per day. So long as his mental condition does not prevent it he falls asleep for similar reasons as the hibernating

animal does. Should a hypnotic be necessary, morphine in doses from 0.0075 to 0.005 gram ($\frac{1}{12}$ to $\frac{1}{8}$ gr.) is not alone the safest and promptest, but withal the most valuable of this class of remedies, as it retards the processes of general metabolism, thereby acting as a tissue sparer.

Medication for local pathological states, as gangrene and infection, is, of course, necessary. A remedy thus employed differs entirely from a drug that is supposed to ameliorate the diabetic condition as such.